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APPLICATION

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TITLE: HEIGHT-ADJUSTMENT MECHANISM FOR AN ARMREST

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HEIGHT-ADJUSTMENT MECHANISM FOR AN ARMREST

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally to adjustable chairs, and more particularly to a height-adjustment mechanism for an armrest.

[0002] Various designs for height-adjustable armrests are known. Some known designs require numerous parts and relatively expensive materials, making such designs less cost competitive. Other known designs include relatively few parts, making them generally less expensive, but such designs may not appear to be of a high quality.

[0003] For example, U.S. Patent No. 5,318,347 issued to Tseng ("Tseng '347") discloses a design for a height-adjustable armrest unit comprising an L-shaped support bar, a vertical sleeve, and a leverage body. In Tseng '347, a tongue provided at a lower end of the leverage body is adapted to engage a positioning hole located on the support bar. The leverage body may be pivoted to disengage the tongue from the positioning hole to allow the sleeve (and the leverage body) to be vertically adjusted relative to the support bar. While Tseng '347 may reduce product cost with fewer parts, the design may not provide a user with a sense that the armrest adjustment mechanism is of a high quality.

[0004] Consequently, what is needed is a height-adjustment mechanism for an armrest which can be manufactured at a low cost, yet is long-lasting and capable of giving a user a sense of high quality.

SUMMARY OF THE INVENTION

[0005] The present invention provides a height-adjustment mechanism for an armrest. In an embodiment, the height-adjustment mechanism includes an integral, one-piece leverage body; and an integral, one-piece sleeve. These parts may be made of low cost

materials suitable for integrally forming their features in an injection moulding operation. Various features built into these parts may provide a user with a sense of quality.

[0006] In an embodiment, the integral one-piece sleeve has pivot seats formed on a pair of locking arms depending from a first wall of the sleeve.

[0007] The pivot seats may be suitably shaped to receive pivot pins and facilitate rotation of the pivot pins therein.

[0008] The pivot seats may be generally U-shaped and inclined downwardly, such that pivot pins receive therein are prevented from being unseated when pulled upwardly.

[0009] The locking arms may extend upwardly and cant away from the first wall of the sleeve.

[0010] The locking arms may be sufficiently resiliently flexible to facilitate snap-fitting of pivot pins between the locking arms and an inner wall of the sleeve.

[0011] The sleeve may be made of a material suitable for integrally forming the locking arms in an injection-moulding operation.

[0012] The leverage body may have a handle, a resilient biasing member projecting forwardly, a tongue projecting rearwardly, and a pair of pivot pins projecting from opposite sides, the pivot pins being seated in the pivot seats.

[0013] The leverage body may be elongate, with the handle being located at an upper portion of the body, the tongue being located at a lower portion of the body, and the pair of pivot pins being located intermediately between the handle and the tongue.

[0014] The resilient biasing member may project forwardly to engage the first wall of the sleeve and bias the pivot pins rearwardly into the pivot seats when a neck of the leverage body abuts the first wall of the sleeve.

[0015] The leverage member may be made of a material suitable for integrally forming the handle, the resilient biasing member, the tongue and the pivot pins in an injection-moulding operation.

[0016] Anti-rattling fingers may be provided to prevent rattling between the various parts of the height-adjustment mechanism.

[0017] These and other aspects of the invention will become apparent through the illustrative figures and accompanying description provided below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] In the figures which illustrate example embodiments of this invention:

FIG. 1 is a view of an illustrative chair that may embody the invention.

FIG. 2 is an exploded perspective view of a height-adjustment mechanism for an armrest in accordance with an embodiment of the invention.

FIG. 2A is a detailed view of a locking arm depending from a first wall of a sleeve in the height-adjustment mechanism of **FIG. 2**.

FIG. 3 is a cross sectional side view of the height-adjustment mechanism of **FIG. 2** showing the leverage body in a first position.

FIG. 4 is the cross sectional side view of **FIG. 3** showing the leverage body in a second position.

FIG. 5A is a cross sectional side view of a portion of **FIG. 2**.

FIG. 5B is a cross sectional side view of another embodiment of this invention.

FIG. 6 is a cross sectional front view of a portion of the height-adjustment mechanism of **FIG. 2** showing a feature detail of yet another embodiment of the invention.

FIG. 7A – 7D are views of a feature detail of yet another embodiment of the invention.

FIG. 8 is a perspective view of another embodiment of the leverage body of **FIG. 2**.

DETAILED DESCRIPTION

[0019] Referring to **FIG. 1**, shown is an illustrative chair **11** that may embody the present invention. The chair **11** has a chair seat **13** mounted on a chair seat frame **10** and supported by a chair seat support **21**. A backrest **15** is supported on a backrest support **17**, and the backrest support **17** is mounted on the chair seat frame **10**. The chair **11** may further include a pair of armrests, each armrest including a height-adjustment mechanism **20** supported on an armrest support **30**.

[0020] **FIG. 2** shows an exploded perspective view of a height-adjustment mechanism **20**, in accordance with an exemplary embodiment of the invention. As shown, the height-adjustment mechanism **20** may include a sleeve **40** and a leverage body **60**. The sleeve **40** and leverage body **60** are adapted to mount to and engage the armrest support **30**, as explained below.

[0021] In the exemplary embodiment, the support **30** is an L-shaped bar having a first arm **30a** and a second arm **30b**. In use, the first arm **30a** is generally horizontally oriented and may include a plurality of mounting holes **32** for mounting the support **30** to the chair seat frame **10** (using mounting screws, not shown). The generally vertically oriented second arm **30b** of the support **30** may include a plurality of vertically spaced slots **34**. In an embodiment, a vertical groove **36** may join all of the slots **34**. As will be explained further below, a protruding tongue **64** formed on a lower portion of the leverage body **60** is adapted to selectively engage one of the slots **34**, and the vertical position of the slot **34** engaged by the tongue **64** will determine the vertical position of the height-adjustment mechanism **20**.

[0022] In order to support the height-adjustment mechanism **20**, and the weight placed on the height-adjustment mechanism **20** by an occupant of the chair **11**, the support **30** should be made of a sufficiently strong and rigid material. For example, in the exemplary embodiment, an elongate plate made of steel, or another suitable metal, may be used. Other materials such as reinforced plastics and carbon composites may also be used.

[0023] Still referring to **FIG. 2**, the sleeve **40** may be formed as an integral, single-piece, injection-moulded structure. For example, the sleeve **40** may be formed of a plastic

material that may be injection-moulded in the desired shape. As shown, the sleeve **40** is adapted to be vertically oriented in use and has an upper end **42** and a lower end **43**. The lower end **43** of the sleeve **40** has an opening **44** suitably sized to receive the generally vertically oriented second arm **30b** of the armrest support **30**. The upper end **42** of the sleeve **40** is suitably shaped to receive an armrest pad **50** (**FIG. 3**). Mounting holes **41a** and **41b** are provided at the upper end **42** of the sleeve **40** to mount the armrest pad **50** (using mounting screws, not shown).

[0024] Still referring to **FIG. 2**, the sleeve **40** is shown in a partial cutout view with an arrangement of structural reinforcing ribs located on each inside wall of the sleeve **40**. A first pair of reinforcing ribs **48a, 48b** is located on a first inside wall **48** of the sleeve **40**. A second pair of reinforcing ribs **52a, 52b** is provided on an opposite inside wall **52** of the sleeve **40**. Additional reinforcing ribs **54a** and **56a** are provided on inner side walls **54** and **56**, respectively, which extend between the first and second walls **48** and **52**.

[0025] Together, the edges of the reinforcing ribs **48a, 48b, 52a, 52b, 54a** and **56a** form a "channel" **45**. As shown, the channel **45** is aligned with opening **44** to slidably receive the vertically oriented second arm **30b** of the support **30**.

[0026] Still referring to **FIG. 2**, a notch **58** is provided at the top of the first wall **48** of the sleeve **40**. As shown, the notch **58** is suitably sized to allow a portion of the leverage body **60**, namely the handle **68**, to extend outside the sleeve **40**.

[0027] Still referring to **FIG. 2**, the leverage body **60** is formed as an integral, single-piece, injection-moulded body. For example, the leverage body **60** may be made of a plastic material injection-moulded into the desired shape. In the exemplary embodiment, the leverage body has a generally elongate body with a pair of pivot pins **62a, 62b** located intermediately along its length. The tongue **64**, as mentioned earlier, protrudes from a lower portion of the elongate leverage body **60**. Also, a biasing member **66** of the leverage body **60** extends outwardly in a direction opposite the tongue **64**. As mentioned, a handle **68** is provided at an upper end of the leverage body **60**. The handle **68** allows an operator to pivot the leverage body **60** about the pivot pins **62a, 62b**. In operation, the biasing member

66 provides a biasing force, acting against the force applied by the operator to the handle **68** of the leverage body **60**.

[0028] Referring now to **FIG. 2A**, and still referring to **FIG. 2**, depending from the first wall **48** of the sleeve **40** are first and second locking arms **57a** and **57b** having pivot seats **53a** and **53b** formed therein. As shown in **FIG. 2**, these locking arms **57a** and **57b** are suitably positioned to receive the pivot pins **62a**, and **62b** of leverage body **60**. As shown in **FIG. 2A**, the pivot seats **53a** and **53b** formed on the locking arms **53a** and **53b** open towards the first wall **48**.

[0029] In the exemplary embodiment, the sleeve **40** is formed as an integral, single-piece, injection-moulded structure. The pivot seats **53a** and **53b** are formed into the inner sides of vertically oriented locking arms **57a**, **57b**, which are themselves integrally formed with the sleeve **40** by injection-moulding. As will be appreciated by those skilled in the art, the pivot seats **53a**, **53b** may be formed by the use of auxiliary mould inserts (not shown) inserted into an injection-moulding cavity for forming sleeve **40**. For example, an extractable pair of moulding pins may be inserted into the injection-moulding cavity for forming sleeve **40** at an angle offset from the main axis of separation of the injection mould for forming sleeve **40**. In an embodiment, access holes **53a'** and **53b'** may be formed in the first wall **48** of the sleeve **40** as a result of the pair of moulding pins being inserted into the injection-moulding cavity while forming sleeve **40**.

[0030] Still referring to **FIG. 2A**, the pivot pins **62a**, **62b** of the leverage body **60** may be received in the pivot seats **53a**, **53b** by fitting the pivot pins **62a**, **62b** in between the locking arms **57a**, **57b** and the first wall **48** of the sleeve **40**, as shown at L. In the exemplary embodiment, a ramp **59** may be provided on each locking arm **57a**, **57b** to facilitate fitting the pivot pins **62a**, **62b** into the pivot seats **53a**, **53b** during assembly.

[0031] In an embodiment, each of the locking arms **57a**, **57b** and, optionally, the wall **48** may be somewhat resilient to permit the pivot pins **62a**, **62b** to be snap fit past the top of the ramps **59**, and into the pivot seats **53a**, **53b** formed in the locking arms **57a**, **57b**. However, the locking arms **57a**, **57b** and the wall **48** should be sufficiently strong such that,

once seated in the pivot seats **53a**, **53b**, the leverage body **60** is firmly secured in position for subsequent pivoting operations by an operator.

[0032] In an embodiment, the pair of pivot seats **53a**, **53b** may be formed at a suitable downwardly directed angle, relative to a notional horizontal plane passing through the sleeve **40**, such that operation of the leverage body **60** by an operator in a lifting manner (as described below and best shown in **FIG. 4**) will not inadvertently unseat the pivot pins **62a**, **62b** from the pivot seats **53a**, **53b**.

[0033] In an embodiment, the locking arms **57a**, **57b** may extend upwardly and cant away from the first wall **48**.

[0034] The height adjustment operation of the height-adjustment mechanism **20** will now be explained.

[0035] Referring to **FIG. 3**, the sleeve **40** is shown mounted on the vertically oriented second arm **30b** of the armrest support **30**. The leverage body **60** is shown with its pivot pins **62a** and **62b** seated within the pivot seats **53a** and **53b** and secured thereat by the locking arms **57a**, **57b**.

[0036] As shown, with the neck **67** of body **60** abutting the base of notch **58**, the biasing arm **66** of the leverage body urges the pivot pins **62a**, **62b** into the pivot seats **53a**, **53b** to keep the pivot pins **62a**, **62b** seated therein.

[0037] As shown in **FIG. 3**, the handle **68** of the leverage body **60** extends through the notch **58** in the first wall **48** of sleeve **40**. Within the sleeve **40**, the biasing arm **66** of leverage body **60** engages the first wall **48** and biases the leverage body **60** away from the first wall **48**. When the leverage body **60** is not pivoted by an operator, the biasing force provided by the biasing arm **66** causes the tongue **64** protruding from the lower portion of the leverage body **60** to continuously engage one of the slots **34** in the support **30**. As noted earlier, the vertical position of the slot **34** engaged by the tongue **64** determines the vertical height of the height-adjustment mechanism **20**.

[0038] As shown in **FIG. 4**, in order to adjust the height of the height-adjustment mechanism **20**, the handle **68** of leverage body **60** may be lifted or pulled back by an operator in direction **A**. This action by the operator will cause the leverage body **60** to pivot about pivot pins **62a** and **62b**, against the biasing force of the resiliently flexible biasing arm **66**. The biasing arm **66** is resiliently deformed when the handle **68** is lifted by the operator such that the biasing arm **66** will act to reengage the tongue **64** with one of the slots **34** when the handle **68** is released.

[0039] In one embodiment, the tongue **64** includes a base **64a**, and a tip **64b**. As shown, when the leverage body **60** is pivoted about pivot pins **62a** and **62b**, the base **64a** of the tongue **64** disengages from the slots **34**, as shown at **B**. However, the tip **64b** of the tongue **64** remains engaged in the vertical groove **36** (**FIG. 2**). As the vertical groove **36** runs the length of the slots **34**, the leverage body **60** and the sleeve **40** may be adjusted vertically, as indicated at **C**, relative to the support **30**. The tongue **64** continuously guides the leverage body **60** within the vertical groove **36**, thereby allowing the base **64a** of tongue **64** to more readily engage any one of the slots **34** when the operator finally releases the handle **68**.

[0040] In an embodiment, the vertical adjustment of the height-adjustment mechanism **20** by the operator may be limited at an upper and lower limit by the tip **64b** of the tongue **64** engaging the top and bottom of the slot **36**.

[0041] Referring to **FIG. 5A**, in an embodiment, an offset **38** may be formed in the support **30** at the top of the vertical groove **36** to accommodate and guide the tip **64b** of the tongue **64** of the leverage body **60** when the height-adjustment mechanism **20** is first slidably received on the support **30**. When this offset **38** is provided, a separate feature may be provided to limit vertical adjustment of the height-adjustment mechanism **20**. For example, a protuberance **39** (seen from the back in **FIG. 2**) may be formed and suitably located on the vertically oriented second arm **30b** of the support **30**. The protuberance **39** may be ramped in a downward direction such that an inwardly extending part **45** of sleeve **40** will deform and pass over the protuberance **39** on the way down, when the sleeve **40** is first installed, but the inwardly extending part **45** of sleeve **40** will catch on the protuberance **39** on the way up. Thus, the protuberance **39** may prevent the height-adjustment mechanism **20** from being inadvertently lifted clear off the support **30** by the operator.

[0042] Referring to **FIG. 5B**, as shown in this alternative embodiment, the offset **38** of **FIG. 5A** may be absent. In this case, in order to assist in fitting the tip **64b** of the tongue **64** over the top of the support **30** and into the vertical groove **36** (**FIG. 2**) during assembly, a ramped surface **64c** may be provided on the lower portion of the tip **64b**. As the tip **64b** otherwise remains the same, the tip **64b** having the ramped surface **64c** may continue to engage the vertical groove **36,** as described above.

[0043] Referring to **FIG. 6**, in a further embodiment, a flexibly resilient anti-rattling finger **46** may be formed on one of the inner side walls **54**, **56** of the sleeve **40** to flexibly bias the support **30** against the opposite one of the inner side walls **54**, **56** of the sleeve **40**. In operation, the anti-rattling finger **46** acts to reduce or prevent rattling between the sleeve **40** and the support **30**, providing the operator of the height-adjustment mechanism **20** with a more smooth and solid feel.

[0044] Advantageously, as the locking arms **57a**, **57b** are formed integrally with the sleeve **40**, no separate locking member is required to secure the leverage body **60** in position. Also, the provisioning of a biasing member **66** on the leverage body **60** facilitates secure seating of the pivot pins **62a**, **62b** within the pivot seats **53a**, **53b**, and prevents rattling between the two pieces. Consequently, a two-piece height-adjustment mechanism, with each piece being formed as an integral, one-piece, injection-moulded structure, provides a completely functional design that may provide a user with a sense of high quality.

[0045] Furthermore, the height-adjustment mechanism **20** may be readily assembled in a single step, and may be shipped as a ready-to-install, assembled unit. Alternatively, each of the leverage body **60** and the sleeve **40** may be shipped unassembled, and may be readily assembled in the field. Also, either item may be readily replaced in the field at the end of the item's useful life. More particularly, locking arms **57a**, **57b** may be manually displaced to free body **60** from sleeve **40**.

[0046] Referring to **FIGs. 7A – 7D**, in a further embodiment, rather than moulding a resilient finger **46** in sleeve **40**, the sleeve **40** may be moulded to include a track **82** along a

length of a reinforcing rib **54b'**. As shown in **FIG. 7D**, the track **82** may have retaining walls **83** to retain an insert **84** having a plurality of projecting anti-rattling fingers **86**. The anti-rattling fingers **86** extend to abut an edge of the support **30**. The anti-rattling fingers **86** are resiliently flexible and may be suitably shaped and sized so they will push the support **30** against the opposite side of the channel **45** (**FIG. 2**) of sleeve **40** to remove any tolerances between the sleeve **40** and the support **30**. In this regard, the insert **84** may be made integrally formed of a resilient plastic material. Advantageously, the anti-rattling fingers **86** may provide a smooth gliding action when the height-adjustment mechanism **20** is adjusted.

[0047] In yet another embodiment, as shown in **FIG. 8**, an alternative leverage body **60'** has a biasing member **66'** extending from an intermediate region, rather than extending from a bottom end as shown at **60** in **FIG. 2**. It will be apparent that this alternative leverage body **60'** is interchangeable with the leverage body **60** of **FIG. 2**. It will also be apparent that a biasing member may be integrally formed on the leverage body **60** at various other locations, and that such a biasing member may be embodied in various other configurations.

[0048] While an exemplary embodiment of the invention has been shown and described, it will be apparent to those skilled in the art that various modifications and alterations may be made. Therefore, the invention is defined in the following claims.